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International SEMATECH Demonstrates Phase One of Low-K Material Evaluations

International SEMATECH has announced it has completed the first phase of evaluation of a number of Low-K dielectric films for production of advanced interconnect structures in sub-180 nm devices.

Paul Winebarger, Director of Interconnect at International SEMATECH, said, "International SEMATECH's goal in evaluating Low-K materials is to provide member companies with information that will enable them to select the most promising materials for their advanced manufacturing processes. Our program focuses on a number of critical issues, including extensive material characterisation, process integration, and electrical performance."

Low-K dielectrics, rather than conventional silicon dioxide, will be required to continue miniaturisation of integrated circuits while still providing higher speed and performance. The results specifically examine techniques and knowledge that can accelerate the adoption of Low-K materials into copper damascene interconnect technology. SEMATECH has successfully fabricated one-level copper damascene test structures with a number of Low-K dielectric films. These structures complete the first phases of evaluation for films with dielectric constant in the range of 3.0-2.1. This work is designed to identify the key issues for successful Low-K-based interconnect fabrication for its member companies.

Participants and the materials used in the fabrication of these one-level metal devices were: Applied Materials (Black Diamond); Asahi Chemical (ALCAP-S); Dow Chemical (SILK, BCB); Dow Corning (XLK, 3MS); Hitachi Chemical (HSG RZ25); Honeywell Electronic Materials (HOSP, FLARE, Nanoglass); JSR (LKD), Novellus (CORAL, AF4); Battelle PNNL (Mesoporous silica); and Schumacher (PAE-2).

Tools and suppliers used to fabricate the test devices included: Low-K spin tools provided by Tokyo Electron Ltd. (TEL); curing furnace provided by TEL; Low-K etch and strip using LAM, Applied Materials, Eaton SEO and TEL equipment and processes; copper deposition using Novellus and SEMITool equipment and processes; CVD dielectric depositions supplied by Novellus and Applied Materials; and CMP tools and process supplied by Applied Materials and IPEC/Westech.

International SEMATECH will continue this testing, but work will now focus on new materials with even lower dielectric constant needed for the generations following 180 nm. The scope and method of evaluation was established with input from member company representatives, suppliers, and researchers from universities and national laboratories to measure the physical, electrical and thermo-mechanical properties of low-k materials. International SEMATECH's member companies accept these procedures and their applications as a means of producing reliable, unbiased data to facilitate comparisons between candidate low-k materials. Work by International SEMATECH with any material, method, tool or

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"This work is a learning and data gathering process. Representative materials from those that have been tested at one-metal level will now be used to attempt fabrication of via chain structures with two levels of copper metal in Low-K dielectric," Winebarger said.

Edited by Mark Osborne

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